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MASTER OF MILITARY STUDIES

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**TITLE:**

**USMC ELECTRONIC WARFARE 2025: TRADING EXPERTISE FOR ADVANCED  
TECHNOLOGY**

SUBMITTED IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF MILITARY STUDIES

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**MAJOR ZEB GOSIK**

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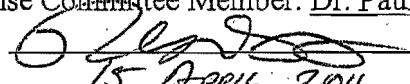
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## **Executive Summary**

**Title:** USMC Electronic Warfare 2025: Trading Expertise for Advanced Technology

**Author:** Major Zeb Gosik, United States Marine Corps

**Thesis:** This paper explains why the planned Marine Corps transition to the F-35 Joint Strike Fighter (JSF) and use of Unmanned Aircraft Systems (UAS) to conduct Electronic Warfare (EW) for the Marine Air Ground Task Force (MAGTF) after 2019 will deplete the USMC of its subject matter experts and create a need for external support to carry out the EW mission.

**Discussion:** The U.S. Marine Corps has committed to conducting EW beyond 2025 and is attempting to acquire the equipment needed to continue executing the mission. Dominance of the electromagnetic spectrum, for the commander, will continue to be the goal of MAGTF EW no matter what method is used. By planning to upgrade EW capabilities with the JSF, unmanned systems and new jamming technologies the USMC will significantly increase its organic capability to conduct all aspects of EW. The new technologies, linked together via a network, will provide access to battlefield information for more warfighters at all levels of the chain of command.

Introduction of new platforms and technologies to conduct EW will coincide with the reduction of existing subject matter experts, as the EA-6B is phased out of service. This will leave Radio Battalion (RADBN) Marines as the single community with the primary mission of conducting EW for the USMC. Historically, RADBN has focused on the terrestrial battlefield aspect of EW and was concerned with different types of enemy equipment than what will be only part of the target set for the JSF and UAS. The new roles that RADBN will need to fill will require additional training and manpower to effectively conduct EW for the MAGTF.

Additionally, the loss of a dedicated tactical aircraft to conduct EW will negatively affect the capability of the USMC to conduct airborne EW. The capability of the JSF to serve as a dedicated jamming platform will be conflicted by the willingness of its operators to execute that mission. Limitations on formal schooling, training time and rehearsal of EW missions will cause electronic warfare to be simply a mission capability and not a skill set that can be executed with any significant level of proficiency. The JSF will be a highly versatile platform, capable of executing all functions of Marine aviation, but without a prioritized set of missions to perform in combat it will become a "jack of all trades and master of none."

Solutions to the planned transition include assigning primary and alternate missions to JSF squadrons or contracting personnel to serve as EW subject matter experts. JSF squadrons with primary and alternate missions could focus their training and develop a deeper level of expertise. Contracted experts would provide the level of knowledge, experience and continuity needed to successfully conduct EW for the MAGTF. These contractors could be assigned to JSF or UAS combat units as well as to staffs that need the advice of EW experts.

**Conclusion:** The future capability needed to successfully conduct EW for the MATGF will certainly exist, in the form of the equipment available, after the retirement of the EA-6B airframe and beyond 2025. The piece that will be missing is the operational expertise in the field of airborne electronic warfare during the transition period away from legacy equipment. EA-6B pilots and Electronic Countermeasures Officers (ECMOs) have provided EW subject matter

expertise to the MAGTF for what will be almost 45 years, by 2019. These organic EW experts have enabled mission success in technologically complex combat environments and have an essential niche to fill in the future Marine Corps. EW will remain a critical war fighting capability for the MAGTF, and the ability to maintain dominance within the electromagnetic spectrum will be paramount as the reliance on advanced technology continues in the U.S. Armed Forces.

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THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENT AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

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## *Preface*

This paper is the product resulting from concerns I anticipate in 8 to 10 years that will occur to Marine Tactical Aviation and the airborne Marine Electronic Warfare (EW) capability. As an EA-6B Electronic Countermeasures Officer (ECMO), I anticipate that both the United States Marine Corps and all of the Department of Defense (DoD) will suffer from a lack of proficiency in being able to conduct all six functions of Marine Aviation and effective airborne electronic warfare. The desire to shift DoD aviation capability toward unmanned systems and a common multirole platform, based on stealth technology, to ensure access to enemy targets and provide air superiority will greatly limit the electronic warfare capability of the force to conduct airborne strikes deep into hostile territory.

In addition to a reduced proficiency in the conduct of EW, the USMC will devoid itself of its subject matter experts in regard to airborne EW. This will force Radio Battalion Marines to fill billets that are better suited for EA-6B pilots and ECMOs. An increased workload for Radio Battalion will have the same effect that the assumption of an additional function of Marine aviation will have on JSF pilots, decreased proficiency and less depth of knowledge.

I would like to thank the staff of the Weapons Requirements Branch (APW-41) at the Marine Corps Department of Aviation and the EA-6B staff at Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) for their assistance in conducting research for this project. Their knowledge and insight concerning airborne EW and its application to the Marine Corps was essential in completing my work.



## **INTRODUCTION**

The Marine Aviation Plan (MAP) is a consolidated action plan that outlines the future Marine Corps aviation organization based on current structure and planned future initiatives. The MAP is produced each fiscal year by the Deputy Commandant for Aviation (DCA) and attempts to provide a roadmap to meet the desired goals that the Commandant of the Marine Corps has for the aviation element of the Marine Air Ground Task Force (MAGTF) until 2025.<sup>1</sup> The MAP is responsible for providing force structure guidance for all six functions of Marine Aviation. The six functions of Marine Aviation are: assault support, aerial reconnaissance, anti-air warfare (AAW), offensive air support (OAS), control of aircraft and missiles and electronic warfare (EW). The MAP ensures that the Commandant's vision of the future Corps is supported by its aviation assets and ready to face an "increasingly volatile and uncertain future."<sup>2</sup> However, as it is currently outlined in the MAP, the planned Marine Corps transition to the Joint Strike Fighter (JSF) and use of Unmanned Aircraft Systems (UAS) to conduct electronic warfare (EW) for the Marine Air Ground Task Force (MAGTF) after 2019 will deplete the USMC of its subject matter experts and create a need for external support to carry out the EW mission.

The Fiscal Year 2011 MAP outlines the plan for the USMC to conduct airborne EW by describing the scheduled upgrades and eventual retirement of the EA-6B and introduction of the Marine Corps Tactical UAS (MCTUAS). The EA-6B "Prowler" is one of two Tactical Aviation (TACAIR) platforms in the Department of Defense (DoD) inventory with the mission of conducting electronic attack (EA), the other is the Navy's EA-18G "Growler". The USMC EW plan calls for a continued transition to the Improved Capabilities (ICAP) III version of the EA-6B by three of its four remaining squadrons and the retirement of the airframe beginning in 2016 and completing at the end of 2019. The MCTUAS will reach its initial operational capability

(IOC) in 2016. The MAP proposes that the follow on systems that will replace the Prowler are the inherent capabilities of the F-35B Joint Strike Fighter (JSF), Next Generation Jammer (NJG) technology and Unmanned Aircraft Systems (UAS) with EW payloads.<sup>3</sup> These new platforms and technologies will be linked by a network and accessible at multiple levels of the chain of command. Introducing this equipment during the simultaneous phasing out of personnel trained to conduct airborne EW will leave the USMC unprepared to exploit the full potential of the new hardware and lead to dependence on external support to successfully conduct service wide EW.

A technological solution to the future conduct of MAGTF EW is sufficiently planned out by the Fiscal Year 2011 MAP and the *Concept of Operations for Marine Air Ground Task Force Electronic Warfare*. However, what the MAP and *Concept of Operations for MAGTF EW* insufficiently address is what personnel will provide the subject matter expertise currently resident in the USMC for EW after the retirement of the Prowler and its crews. Currently the Prowler and Radio Battalion (RADBN) communities supply the MAGTF with the necessary EW experts. A shortfall in expertise is destined to arise with the elimination of one of those communities. This particularly holds true when looking at the increased dependence that U.S. Armed Forces have placed on technology that operates within the electromagnetic spectrum (EMS) to successfully carry out their mission. A smaller number of EW experts and the requirement for RADBN to increase in “capacity, training, and flexibility”<sup>4</sup> will leave the USMC playing catch up at a time of transition to new technologies and reliance on the EMS to quickly and decisively achieve mission success.

### **MAGTF EW MISSION**

The mission of MAGTF EW is to “dominate the electromagnetic spectrum by targeting, exploiting, disrupting, degrading, deceiving, damaging, or destroying” the enemy’s “electronic

systems that support their military operations.”<sup>5</sup> By accomplishing this mission the friendly commander gains a decisive advantage and can exploit the EMS to successfully accomplish the mission. As defined by *Joint Publication 1-02*, Electronic Warfare is any military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or attack the enemy.<sup>6</sup> Electronic warfare is divided into three components which are: electronic attack (EA), electronic protection (EP) and electronic warfare support (ES). Each of these components is used in concert with one another as a form of fires to achieve spectrum dominance.

Electronic attack (EA) is the component “of electronic warfare involving the use of electromagnetic energy, directed energy, or antiradiation weapons to attack personnel, facilities, or equipment with the intent of degrading, neutralizing, or destroying the enemy combat capability.”<sup>7</sup> EA is a non-kinetic form of fires which is predominantly offensive in nature but can also involve electromagnetic deception efforts such as false or duplicate target generation. The conduct of EA against an enemy usually has the goal of preventing the use of RADAR or communication equipment to allow friendly forces to maneuver on the battlefield undetected or restrict the enemy’s information flow.

Electronic protection (EP) is “that division of electronic warfare involving actions taken to protect personnel, facilities, and equipment from any effects of friendly or enemy use of the electromagnetic spectrum that degrade, neutralize, or destroy friendly combat capability.”<sup>8</sup> EP is normally passive in nature, such as the use of emissions control (EMCON) procedures but can also include active methods such as deploying chaff and other expendables. The scheme of maneuver for ground units can employ EP by placing terrain between the selected avenue of approach and enemy forces. Additionally, most pieces of military equipment are built with a

certain degree of EP inherent in their design. These design features include radio frequency shielding, directional antennas and reduced power modes.

Electronic warfare support (ES) is the component “of electronic warfare involving actions tasked by, or under direct control of an operational commander to search for, intercept, identify, and locate or localize sources of intentional and unintentional radiated electromagnetic energy for the purpose of immediate threat recognition, targeting, planning and conduct of future operations.”<sup>9</sup> ES is basically a passive intelligence gathering effort that can be used to generate data necessary for a myriad of military functions including physical destruction, EA, support of Information Operations (IO) and database creation. ES successfully exploits an enemy’s electromagnetic emissions and may provide information on enemy capabilities and intentions.<sup>10</sup>

The resources organic to the MAGTF that are tasked with conducting EW are RADBNs and Marine Tactical Electronic Warfare Squadrons (VMAQs). These units primarily conduct EA and ES functions while incorporating EP measures into their operations. Doctrinally, a single RADBN provides support to a Marine Expeditionary Force (MEF) but can be task organized to support smaller MAGTF elements.<sup>11</sup> Four VMAQ squadrons exist in the USMC to conduct EW for the force and generally one or two squadrons are deployed for combat operations. Because of their limited numbers and specialized capabilities VMAQ squadrons normally provide precedence of support to the joint force, leaving RADBNs the only true organic USMC asset for the commander to task.

The Electronic Warfare Coordination Cell (EWCC) is the entity within the MAGTF that coordinates and deconflicts EW activities between units and manages the overall effort for the commander. The commander is always the focal point for the conduct of operations and the EWCC falls under the cognizance of the operations officer. The EWCC is scalable depending on the size of the force it supports and its EW subject matter experts are drawn from both RADBNs

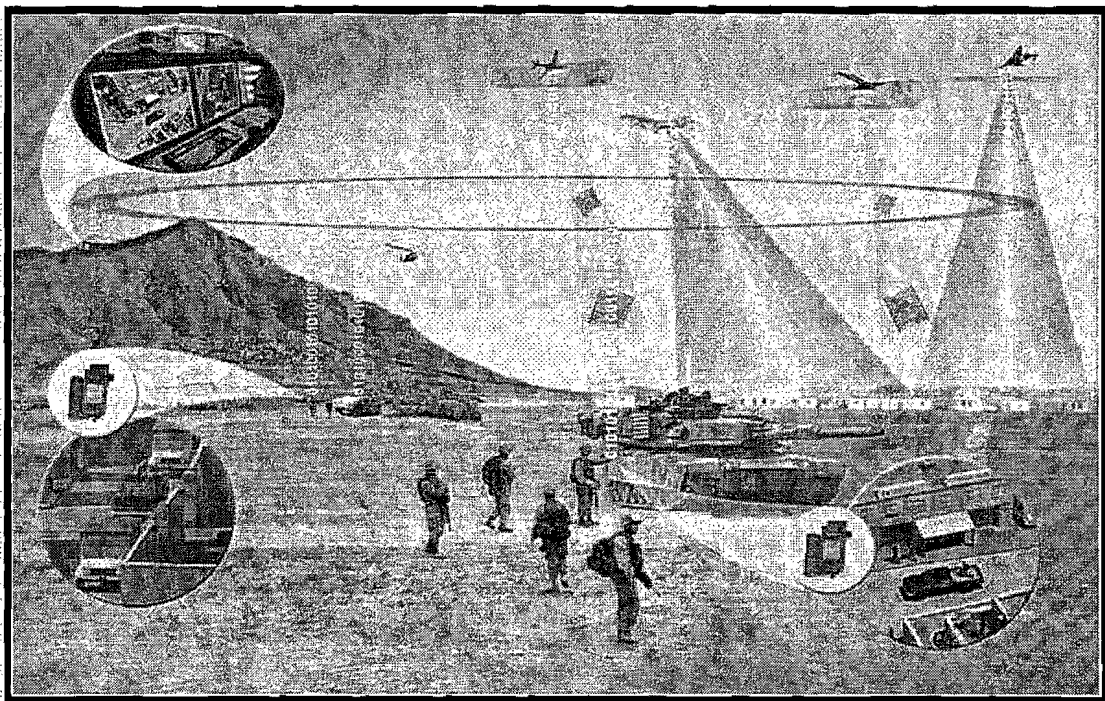
and VMAQ squadrons. Additionally, EW participation in the bigger mission of IO is conducted by the EWCC.<sup>12</sup>

### **MAGTF EW TRANSITION PLAN**

The focus of future MAGTF EW efforts is designed to defeat the anticipated threat beyond 2019 with the ultimate goal of providing organic EW capabilities to the commander. These organic capabilities will enable the commander to maneuver within the EMS and rely on the weapons and command and control systems that ensure mission success. However, as the equipment that we develop continues to place greater reliance on networks and data links, we provide the enemy with the potential to exploit our systems or deny us access to them. Our adversaries have realized this potential vulnerability and plan to use it to their advantage.<sup>13</sup>

The methods for MAGTF EW to prepare for future threats involve the “synergistic integration of capabilities into a holistic system of systems (SoS) in order to provide the MAGTF commander an organic ability to control the electromagnetic spectrum at the time and place of his choosing.”<sup>14</sup> The systems that will accomplish this will be network centric, Internet Protocol (IP) based with software reprogrammable capabilities to allow for non-kinetic effects to be delivered down to the lowest tactical level possible. The concept of a network of systems that is perpetually available and accessible to a multitude of users down to the squad level requires that all components of that system be interoperable and that the individual users on the network be sufficiently trained to access the network and comprehend the information it provides. Additionally, since the effects of non-kinetic fires can adversely affect the conduct of MAGTF operations, a controlling agency must be included in the sequence of clearing the use of EA. Illustrated below is the future vision of MAGTF EW, where collection and attack assets are

perpetually available and linked to the Marine on the ground. The network allows access to information that individual decision makers determine are necessary for mission success.



Marine Corps Department of Aviation, Weapons Requirements Branch (APW-41) illustration. *Depiction of the future vision for MAGTF EW where air and ground elements are continuously connected via a network. The network allows access by multiple users to the information needed to achieve mission success based on the assigned task.*

The proposed concept that will be used to provide the SoS EW capability for the MAGTF is called the Collaborative On-line Reconnaissance Provider / Operationally Responsive Attack Link (CORPORAL). CORPORAL will be an architecture of network enabled and interoperable components that are added to older platforms such as helicopters, jets and ground vehicles and integrated with new systems such as UAS and the JSF.<sup>15</sup> CORPORAL will provide real-time surveillance of the battlefield with imagery and signals intelligence (SIGINT) to infantry squad leaders with the ability to access the network.<sup>16</sup> Access points could include portable laptops, ground vehicle stations, or even hand held devices. The system would also allow individual

users to transfer target data across the network to be used for both kinetic and non-kinetic attacks.

The need for a controlling agency to exist to ensure that the disruptive effects of friendly systems do not impede mission success gives rise to a function called Electronic Warfare Battle Management (EWBM). EWBM is a command and control capability that provides a complete situational understanding of the EW operational environment enabling friendly forces to manage resources during the execution of an electronic warfare mission.<sup>17</sup> The EWBM concept allows for human interaction and decision making authority to prevent fratricide and requires the expertise currently held by Marines in the RADBN and EA-6B communities. The command and control level at which the EWBM function should be accomplished has not been determined. However, for multiple users conducting displaced operations on a non-linear battlefield the authority to take action should reside at the lowest level possible. This will require a greater number of well trained Marines in the conduct of EW and a better understanding of its effects on all warfighters.

Transforming the MAGTF EW capability to the 2025 timeframe will also include changes to current assets and eventually the retirement from service of others. The EA-6B is one EW asset that will experience both upgrades and retirement before 2020. In April 2010 the first of four VMAQ squadrons began the transition to an Improved Capabilities (ICAP) III version of the Prowler. The ICAP III aircraft has a completely upgraded ALQ-218 digital receiver suite that significantly increases the platform's signal targeting capability. This upgrade is the first major modification to the Prowler's receivers since 1971 when it was first introduced to the fleet. The ALQ-218 is the same system that was used by the Navy for its EA-18 Growler and both platforms use ALQ-99 pods for EA. The ICAP III's upgraded receivers and computing capacity

provide greater situational awareness for aircrew, allow for more precise jamming, reduce lifecycle costs and will provide increased aircraft readiness.<sup>18</sup>

Transition to the ICAP III will conclude in fiscal year 2012 at which time the USMC will maintain four squadrons of five aircraft each until 2016. All four squadrons will continue to reside at Marine Corps Air Station Cherry Point, as they currently do now. Beginning in 2016 the first VMAQ squadron will decommission, with one squadron decommissioning each successive year until 2019. After 2019 the new systems acquired, such as the JSF and UAS, will fulfill the EA-6B's role in MAGTF EW.<sup>19</sup>

Included with the decommissioning of the EA-6B is a reduction in the number of personnel trained for the Electronic Countermeasures Officer (7588) Military Occupational Specialty (MOS). As mentioned before, core EW expertise resides in two communities in the USMC and with the removal of one of those communities the EW function of MAGTF IO and the EWCC will suffer. The USMC plans to train Electronic Countermeasures Officers (ECMOs) until 2016; however, the method to accomplish that is yet to be determined. Currently Marine EA-6B pilots and ECMOs are trained at Electronic Attack Squadron One Two Nine, a Navy Fleet Replacement Squadron (FRS). Training is planned to continue until 2014 at the current FRS until the Navy fully transitions to the EA-18G. Once the transition is complete there will not be a Navy training squadron to produce Marine Prowler aircrew. This will force the USMC to assume the training of the crews that will operate Prowlers until 2019.

### **FUTURE EW ASSETS**

The EW platforms of the future will be required to be expeditionary in nature and provide a number of capabilities that give flexibility to the MAGTF commander. These systems are most likely to be smaller and more autonomous than the manned aircraft and ground vehicles that are



used today. According to the Commandant's *Marine Corps Vision and Strategy 2025*, the "future Corps will be increasingly reliant on naval deployment . . . leaner in equipment and versatile in capabilities" to provide flexibility to the commander and sufficiently meet the demands of the hostile world we live in.<sup>20</sup> The evolution of MAGTF EW will require more access by a greater number of users over a dispersed area and delivered by a network of automated systems that respond to a remote user's request. The assets that provide these capabilities will be technologically advanced and require an understanding by the user of their capabilities, limitations and potential negative effects to mission accomplishment.

### **F-35B JOINT STRIKE FIGHTER**

The JSF is the future MAGTF asset that best fits the *Marine Corps Vision and Strategy 2025*. The replacement of three TACAIR platforms (AV-8B, EA-6B and FA-18) with one is the epitome of a system that is "versatile" and "lean". The JSF will combine the basing flexibility of the AV-8B with the multi-role capabilities, speed, and maneuverability of the FA-18 and the EW dominance of the EA-6B.<sup>21</sup> A very low RADAR cross-section, sensor integration and network enabled capabilities will allow the JSF to successfully integrate into the proposed future of MAGTF EW and accomplish the six functions of Marine aviation as well. The inherent jamming capabilities of the aircraft along with the planned use of the Next Generation Jammer (NGJ) will greatly exceed the airborne EW capabilities that exist today.

The NJG is a planned system that will replace the ALQ-99 Tactical Jamming System currently used for airborne electronic attack and carried by the EA-6B. The individual ALQ-99 pods are 15 feet long and weigh about 1000 pounds. Each pod is configured for a specific frequency target set depending on mission requirements and anticipated threats. The ALQ-99 pods are powered by an external ram air turbine (RAT) and contain two steerable antennas which

are capable of generating a large amount of radiated power. NJG will be designed to defeat the complex air defense systems of the modern world, data links and non-traditional radio frequency (RF) threats. NGJ will address the fundamental shortfalls of the ALQ-99 system including degrading relative capability over time, limited number of simultaneous targets, limited interoperability and limited availability due to reduced quantities. The IOC for the NJG is 2018.<sup>22</sup>

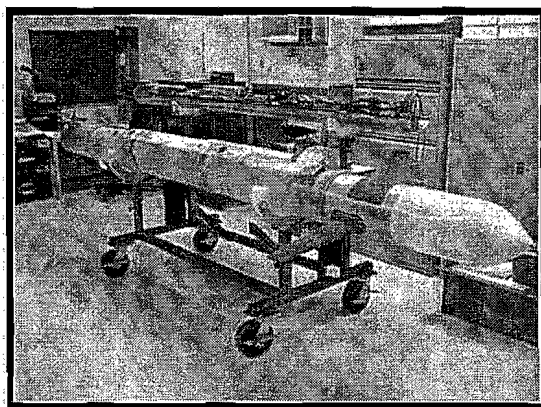
### **ROTARY WING ASSETS**

The role that rotary wing assets will play in the future of MAGTF EW will be a new one. Based on a plan of using a network architecture to conduct EW, any available asset that could serve as a node in the net would potentially provide greater coverage of the battlefield and more fidelity of the operational environment. This type of thinking has been tested with the development of the Intrepid Tiger I pod. Intrepid Tiger I began its concept phase in 2004 and reached IOC in 2005. Developed rapidly to meet an emerging threat during Operation IRAQI FREEDOM (OIF), the pod was designed to defeat RF threats that were unique to that specific theater. Despite its initial limited scope the Intrepid Tiger pod was interoperable with AV-8B Harriers, FA-18 Hornets and the UH-1N Iroquois.

The Intrepid Tiger program continues today in the form of the ALQ-213 Intrepid Tiger II. The second version of the pod is equipped with an expanded frequency range to meet new threats and has an in flight capability to be reprogrammed for operational and tactical flexibility. The pod is designed with an open architecture to allow for easy addition or swapping of components and to simplify the future upgrade process. Additionally, Intrepid Tiger II will play a role in EW battle management and will continue to be interoperable with multiple legacy platforms, other

jamming equipment, including Counter Radio Controlled Improvised Explosive Device Electronic Warfare (CREW) devices and 4<sup>th</sup> Generation LITENING pods.<sup>23</sup>

Intrepid Tiger II's planned interoperability and capabilities make it likely that integration on future USMC rotary wing assets will occur. This trend toward small, highly capable technologies will pave the way for the conceived MAGTF EW network. Such an EW network could be formed with the use of helicopters as nodes, including: MV-22B Ospreys, UH-1Y Venoms, AH-1Z Vipers and CH-53K Super Stallions. The conceived benefits of an EW network with rotary wing assets include their close proximity to the Marines on the ground, which would provide updates across the net without the need for fixed wing or unmanned assets.



Marine Corps Department of Aviation, Weapons Requirements Branch (APW-41) photo.  
*Intrepid Tiger pod expected to be implemented on multiple USMC platforms.*

## **UNMANNED AERIAL SYSTEMS**

Marine Corps use of unmanned aerial systems began in 1986 and the continued growth in capabilities and increased battlespace coverage are a combat multiplier for the commander.

“UAS increase the lethality and effectiveness of our air-ground team by extending our influence over time and space on the battle field. The near future will see these characteristics expand to also include strike, electronic warfare, and combat logistics.”<sup>24</sup> New and more capable UAS will

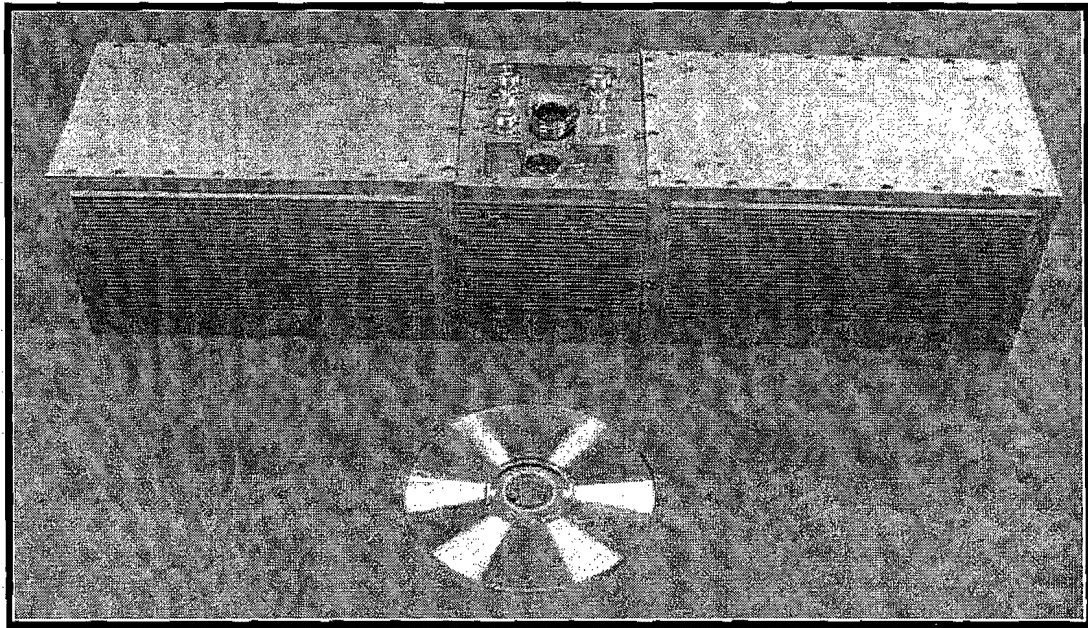
require a larger support structure and trained operators to effectively utilize these assets to their full potential.

MAGTF commanders utilize UAS from various groups of systems in the USMC inventory to augment manned air assets and achieve near continuous coverage. The UAS Group naming convention is standardized across the DoD and a platform's Group is based on capability and logistics requirements. At the battalion level, the smallest systems are used to provide an organic reconnaissance and surveillance capability. These lowest level assets belong to Group 1. Group 2 UAS are larger than Group 1 and have greater speeds and ranges. There are no current or future Group 2 UAS planned for acquisition by the USMC. Group 3 systems are larger and more complex platforms that operate at medium altitudes and have a wide array of sensors that they can carry, including precision guided weapons. Additionally, they can operate from unimproved surfaces and may not require a runway. Marine Unmanned Aerial Vehicle Squadrons (VMUs) operate Group 3 and 4 systems through the use of a Ground Control Station (GCS) and are task organized to support the MAGTF. Group 4 and 5 UAS are the largest systems and bring with them the capabilities of increased range, altitude and endurance. The tradeoffs associated with these systems are an increased logistics footprint and the need for improved surfaces for launch and recovery.<sup>25</sup>

The UAS of the future that will provide EW support to the MAGTF will be a Group 4 platform called the Marine Corps Tactical UAS (MCTUAS). Currently the RQ-7B Shadow, which is a Group 3 system, is filling the requirement for Marine Expeditionary Force (MEF) and Marine Expeditionary Brigade (MEB) level support. However, the Shadow will be replaced in fiscal year 2016 by a larger system. Prior to being replaced by the MCTUAS, the Shadow will have kinetic and non-kinetic EW capabilities incorporated into its mission, suggesting that it will be the first UAS to carry antiradiation ordnance of some kind. Currently the Shadow has the

capability to augment Command and Control (C2) by serving as a radio relay and with the continued development of payloads such as CORPORAL it will increase access to command data networks for units on the battlefield. Once the MCTUAS replaces Shadow, the USMC will possess an expeditionary platform with kinetic strike, Intelligence Surveillance and Reconnaissance (ISR) and EW capabilities.<sup>26</sup>

One emerging technology that has promising applications for use on UAS is called the Software Reprogrammable Payload (SRP). The SRP is an open-architecture reconfigurable software radio that was originally designed to improve battlefield communications for the USMC. Initial capability of SRP has been incorporated into Shadow to provide netted communications and radio relays that are fully compatible with the current inventory of tactical radios. The design allows the SRP to support a wide variety of requirements including ISR and an RF collection application that could be used for ES.<sup>27</sup>



Marine Corps Department of Aviation, Weapons Requirements Branch (APW-41) photo. *Software Reprogrammable Payload (SRP) currently in use with Shadow and planned for use in future UAS. (Compact disk in foreground added to show scale.)*

## **RADIO BATTALION**

“The mission of the Radio Battalion (RADBN) is to provide communications security (COMSEC) monitoring, tactical signals intelligence (SIGINT), EW, and special intelligence communications support to the MAGTF.”<sup>28</sup> RADBN accomplishes its mission through the use of an electronic attack set that enables operators to conduct EA against low-VHF signals from various platforms that include high mobility multipurpose wheeled vehicles (HMMWVs), helicopters and the Mobile Electronic Warfare Support System Product Improvement Program (MEWSS PIP). The MEWSS PIP vehicle is based on the USMC light armored vehicle (LAV) and provides support to highly mobile mechanized operations. MEWSS PIP contains a signals intercept system to detect and categorize non-communications emissions, a direction finding capability and a secure communications system.<sup>29</sup>

Upgrades to the equipment that RADBN will use as MAGTF EW evolves toward 2025 include the Technical Control and Analysis Center (TCAC), the Communication Emitter Sensing and Attacking System (CESAS) and the Teams Portable Communication System-Multi Platform Capable (TPCS-MPC). TCAC is the Marine Corps’ senior SIGINT system which fuses intelligence from organic, theater and national collection assets for dissemination to battlefield MAGTF users. The CESAS is an advanced digital EA system that will provide the commander with the capability to detect, deny and disrupt threat communications. TPCS-MPC is a semi-automated SIGINT system that is capable of direction finding, performing computer-aided signals analysis and providing indications and warnings to the MAGTF. The focus of TPCS-MPC is to be able to have continuous upgrades with the use of Commercial-Off-The-Shelf (COTS) and Non-Developmental Item (NDI) technologies. This will allow for modular configurations that have scalable functionality and can be employed on various vehicles in the USMC inventory.

## **GAPS IN EW CAPABILITY**

The future of MAGTF EW is certainly a difficult problem to plan for and solve.

Consideration must be given to the advancement of technology, the restructuring of manpower to provide operators for the new equipment that will be fielded and the effect of mission consolidation on single seat aviators. All of these issues will interact with one another to form what will be the EW capability of the Marine Corps in 2025. No one area will ensure success or failure. The technology and training pieces are tangible and more quantifiable than the cultural acceptance or willingness of Marines to focus on learning new skills specializing in EW. During the transition period, which coincides with the retirement of the Prowler, there will need to be a dedicated effort to ensure that the MAGTF does not devoid itself of its EW expertise.

Advances in technology have been a strength of the American Armed Forces since World War II. The U.S. continues to be at the forefront of military hardware and will remain so for the foreseeable future. The path that is planned for in EW is no different. Introduction of the JSF with its inherent EA capabilities, stealth and robust communications will allow for Marine aircraft to conduct EW in new ways. Combined with the option of employing the Next Generation Jammer, the F-35 would truly be a multirole platform. The only equipment that would be lacking would be a dedicated on board receiver system, such as the ALQ-218. The mitigation for not having a receiver system would be to provide that type of information via data link.

Additional planned technology acquisitions for the USMC, such as Intrepid Tiger II, CORPORAL and the MCTUAS, will ensure that electromagnetic superiority is maintained by the MAGTF. The rapid response to the improvised explosive device (IED) threats during Operation IRAQI FREEDOM demonstrated how technology, combined with resident expertise, can be used to quickly correct areas of deficiency, such as not having CREW devices. However,

obtaining these types of technology for the future is not a foregone conclusion. The realities of budget constraints and competing programs often prevent acquiring useful equipment. The Marine version of the JSF itself has recently been put on a two year probation period and is getting the personal attention of the Commandant. Recent and unknown future economic pressures may delay or terminate programs that endanger electromagnetic spectrum dominance. Also, because EW is not the first concept that people think of when discussing armed conflict, it has the potential to be a lower priority when monetary cuts must be made.

Overall, from a technology standpoint the USMC has a good plan to achieve spectrum dominance. The unknowns of the future may lead to what would amount to delays in IOC dates for the JSF, NJG and UAS with EW capability. The most likely causes of these delays would be the lack of technology maturation and budget constraints which will be adjudicated by the needs of the infantry Marine. Also, in the acquisition of any new item there will always be tradeoffs between performance, schedule and cost which determine the end product's operational effectiveness. The best course of action that can be taken is to plan for the use of these undeveloped technologies and focus their capabilities on countering the most likely and dangerous anticipated threats of 2025.

Manpower will play the most important role in preparing the MAGTF for its EW mission of the future. Just as the most critical resource of the Marine Corps is its Marines, the most essential element of MAGTF EW is its subject matter experts. Technologies change over time and tactics evolve with a changing threat but what is essential is the presence of experienced personnel that can operate new equipment and implement new tactics. The truthfulness of this became all too evident for the U.S. Army during its experience in OIF.

As the presence of U.S. forces persisted in Iraq and casualties quickly mounted due to Radio Controlled Improvised Explosive Devices (RCIEDs) the Army realized that their service



lacked the EW expertise needed to counter the threat. This resulted in the dependence on expertise from other services, especially the Navy, to save the lives of soldiers in Iraq.<sup>30</sup>

Electronic Warfare experts were recruited from the deploying forces of Navy, Air Force and Marine squadrons and from billets around the services that were “non-deploying”. Any service member with EW expertise was eligible to be recruited as an individual augment (IA) to help the Army. The indirect effect of this reduced the end strength of other services’ EW combat units and was not just a disruption of the career paths of a few sailors, airmen and Marines.

As with the plan to procure the right equipment and to the credit of planners and requirements officers throughout the Marine Corps, steps have been taken in the right direction attempting to prevent the USMC from finding itself in the same position as the Army in OIF. Two of these steps include the creation of a UAS Officer Primary Military Occupational Specialty (PMOS) and engagement with Manpower and Reserve Affairs to leverage the expertise of EA-6B ECMOs once the aircraft is retired.<sup>31</sup> Together these two measures will help address the emerging requirements in the UAS family of systems and preserve the EW expertise needed for initial use of technologies such as the NJG. However, retaining ECMOs and their EW knowledge as UAS Officers or mission planners will not provide a method for the continuance of EW expertise in the service without a professional training facility. Additionally, once the lot of former ECMOs has left the service there will be no Airborne Electronic Attack (AEA) specialists remaining in the MAGTF.

The consolidation of multiple functions of Marine aviation onto a single platform sounds fantastic from a resource allocation point of view. Truthfully though, the more tasks and the greater the dissimilarities between those tasks that a person is asked to perform, the less proficient at any one of them he will be. This is destined to happen with the plan of using the JSF to conduct aerial reconnaissance, anti-air warfare, offensive air support and electronic

warfare. Traditionally, fighter pilots have devoted the majority of their effort to perfecting the difficult sciences of ordnance delivery and air-to-air combat. These two functional areas alone would easily monopolize the training time and resources that a squadron could provide to its pilots and with the additional task of applying EW knowledge to accomplish a completely different mission, some type of training will be sacrificed.

The natural tendency for JSF pilots will be to rely on the cutting edge technology that their platform provides without the ability to identify radio frequency signals by their parametric data or to truly study surface-to-air missile threats and understand their weaknesses. The consequences of this type of mentality displayed themselves in Kosovo during Operation ALLIED FORCE on 27 March 1999 when the first combat loss of a F-117A occurred. The enemy's successful engagement was conducted with the use of a SA-3 employing 1960's technology. Clearly, technology provides an unparalleled advantage but it will never eliminate mission risk or convince a determined enemy that victory is not achievable.

Consolidation of too many missions into the JSF will effectively eliminate AEA experts from the USMC. Pilots can be only as proficient as their training and experience allows and with the lack of error that can be tolerated for delivering ordnance and defeating an air-to-air threat, there simply will not be time to focus on EW. The preservation of the EW expertise in the Marine Corps will require that someone with aviation experience be involved in conducting the mission, either through the operation of a UAS or in support of the JSF. Transitioning away from having dedicated personnel perform the mission of airborne EW is a step backwards in which RADBN Marines, who traditionally focus on battlefield communications, will be forced to learn the tactics of suppressing an integrated air defense system (IADS). This will increase the training requirements for RADBN Marines due to the increased number of systems they will

need to be familiar with and ask them to provide expertise in an airborne operating environment with which they are not familiar.

## **SOLUTIONS**

Anticipation of the future threat to the MAGTF has been a driving factor in tailoring the USMC in terms of personnel and equipment for many years. Absolute certainty can never be achieved when trying to predict the course of future world events or actions of nations.

However, one trend which can be expected to continue is the proliferation of and continued dependence on technology and the EMS to conduct military operations. This trend is absolutely true for the U.S. and the rising nation states of the world. Because of the U.S. reliance on technology alone, an organic expertise in EW is necessary for the Marine Corps. Without EW experts, the USMC will find itself, at best, reliant on another U.S. service for support and at worst, in a situation similar to the Army's during OIF. Measures that could be taken to preserve the organic EW expertise within the MAGTF include having JSF squadrons with the primary mission of EW or contracting personnel to serve as subject matter experts.

The vast amount of air-to-ground and air-to-air capabilities that the JSF brings to the MAGTF is too great to limit it to providing only one function and would be an inefficient use of assets. However, the designation of individual squadrons with primary and alternate missions would allow them to focus heavily on a set number of skills. This would enable pilots to increase their proficiency in a smaller area and generate expertise, instead of trying to be a "jack of all trades". For example, certain squadrons could have the primary missions of aerial reconnaissance and EW with the secondary mission of offensive air support. This would allow the squadron to prioritize its training schedule according to the mission it would be tasked to accomplish in combat. Additionally, the personnel of the squadron could be given dedicated

formal training to better understand the intricacies of reconnaissance and EW. These squadrons could be task organized into the MAGTF to provide extra support where needed or none where replacing them with another unit specializing in anti-air warfare, for example, better suited mission requirements. The squadron would not be precluded from carrying out its secondary mission, if needed, but instead would ensure that every JSF squadron is not overly capable in one skill set and deficient in another.

The current plan of using the JSF in its very low observable mode until the "threat drives you to [a] position that you would put [the] next generation jammer on some,"<sup>32</sup> is a situation where pilots will be unfamiliar with the employment of the equipment and their new self induced lack of stealth. Additionally, this approach lends itself to believing that attaching a pod or new system of some type will solve the problem of defeating advanced surface-to-air threats. Employment of EA, especially in support of low observable aircraft, is a tactic that requires detailed coordination and training. However, if a certain number of JSF squadrons were primarily focused on EA and did not think of themselves as purely stealth aircraft, then they could provide the organic EW support to the MAGTF when the mission required.

The contracting approach to providing EW expertise to the MAGTF would ensure that the highest level of knowledge remained resident in the force. These advisors would be responsible for training, mission planning and evaluating the performance of MAGTF EW operations. EW contactors would need to be educated and have experience in both ground and airborne theaters. By having Marines carry out the missions planned by EW experts, the MAGTF would gain a level of proficiency that is absent in today's force while providing continuity within units.

Contracting subject matter experts also brings with it the ability for those individuals to stay current with emerging technologies in a specialized field and interact with other specialists

at universities and government laboratories. The requirements of Marines to perform their daily tasks prevents them, except for a select few billets, from interacting with researchers from other government organizations and having the freedom to travel to conferences. This would not be the case for a contracted organization that could have employees providing current information on the developments of new threats, emerging technology and changing tactics used by the enemy.

## **CONCLUSION**

The desire of the Marine Corps to continue employing EW in the MAGTF is a commitment that must not only be met with the use of new technology but also with the preservation of organic expertise. The USMC will need systems operators, schools, training facilities and advanced technologies to provide the commander the tools needed for mission success. Without the entire complement of these items there will be a significant decrease in capability for the combat force. Achieving this means that the level of knowledge that currently exist within the USMC cannot be allowed to expire. Whatever the path that is ultimately pursued it must not be forgotten that new equipment is important in the conduct of future warfare but the individual Marine and his abilities are the true deciding factor in achieving victory.

The retirement of the Prowler and dispersion of its EW experts to other facets of the USMC will sustain the MAGTF with expertise if it is done correctly. Former Prowler crewmembers must be able to shape the employment of the systems that assume the EW mission in the future and provide the time needed for RADB N to grow in size and scope. However, simply providing a temporary fix for initially implementing a network of UAS and the JSF will not be the permanent solution. Instead, an acceptance by the JSF community of EW as an important mission and an understanding of UAS operators of the capabilities of their systems

will need to be instituted. The infantry Marine of 2025 will also bear the burden of needing to understand the effects of non-kinetic fires and how UAS with EW capabilities influence his battlespace. Those Marines will require academic training and practice using the advanced tactics at their disposal. Ultimately it will be the responsibility of the MAGTF commander to ensure that the EW assets at his disposal are sufficiently organized and trained to accomplish the mission.

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## **ENDNOTES:**

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<sup>2</sup> Commandant of the Marine Corps, General James T. Conway, *Marine Corps Vision and Strategy 2025*. (Washington, D.C.: Headquarters United States Marine Corps, 2008), p 3, <http://www.marines.mil/news/publications/Documents/Vision%20Strat%20lo%20res.pdf> (accessed October 17, 2010).

<sup>3</sup> Deputy Commandant for Aviation, *Fiscal Year 2011 Marine Aviation Plan*, 2010, p 3-2.

<sup>4</sup> Fires and Maneuver Integration Division, Capabilities Development Directorate Deputy Commandant, *Concept of Operations for Marine Air Ground Task Force Electronic Warfare* (Quantico, VA: Combat Development and Integration, 2010), p 19.

<sup>5</sup> Headquarters United States Marine Corps, *Electronic Warfare*, MCWP 3-40.5 (Washington, D.C.: U.S. Marine Corps, September 10, 2002), p 1-1.

<sup>6</sup> Chairman of the Joint Chiefs of Staff, Director Joint Staff, *Department of Defense Dictionary of Military and Associated Terms*, JP 1-02, (Washington, D.C.: Office of the Secretary of Defense, September 30, 2010), p 153.

<sup>7</sup> Headquarters United States Marine Corps, *Electronic Warfare*, September 10, 2002, p 1-2.

<sup>8</sup> Chairman of the Joint Chiefs of Staff, Director Joint Staff, *Department of Defense Dictionary of Military and Associated Terms*, September 30, 2010, p 153.

<sup>9</sup> Chairman of the Joint Chiefs of Staff, Director Joint Staff, *Department of Defense Dictionary of Military and Associated Terms*, September 30, 2010, p 154.

<sup>10</sup> Headquarters United States Marine Corps, *Electronic Warfare*, September 10, 2002, p 1-2.

<sup>11</sup> Headquarters United States Marine Corps, *Electronic Warfare*, September 10, 2002, p 5-2.

<sup>12</sup> Headquarters United States Marine Corps, *Electronic Warfare*, September 10, 2002, p 2-4.

<sup>13</sup> Fires and Maneuver Integration Division, Capabilities Development Directorate Deputy Commandant, *Concept of Operations for Marine Air Ground Task Force Electronic Warfare*, 2010, p IV.

<sup>14</sup> Marine Corps Department of Aviation, Weapons Requirements Branch (APW-41), "MAGTF Electronic Warfare briefing" (presentation to the Director Air Warfare, November 2010), slide 3.

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<sup>15</sup> Marine Corps Department of Aviation, Weapons Requirements Branch (APW-41), "MAGTF Electronic Warfare briefing" (presentation to the Director Air Warfare, November 2010), slide 5.

<sup>16</sup> G. Goodman, "USMC CORPORAL Project advances," *The Journal of Electronic Defense*, April 2010, p 15.

<sup>17</sup> Fires and Maneuver Integration Division, Capabilities Development Directorate Deputy Commandant, *Concept of Operations for Marine Air Ground Task Force Electronic Warfare*, 2010, p 5.

<sup>18</sup> Program Assessment and Evaluation Division, Program and Resources Department, Headquarters United States Marine Corps, *U.S. Marine Corps Concept & Programs 2010*. Washington D.C.: U.S. Government Printing Office, 2010, p 135.

<sup>19</sup> Deputy Commandant for Aviation, *Fiscal Year 2011 Marine Aviation Plan*, 2010, p 3-2.

<sup>20</sup> Commandant of the Marine Corps, *Marine Corps Vision and Strategy 2025*, 2008, p 6.

<sup>21</sup> Program Assessment and Evaluation Division, Program and Resources Department, Headquarters United States Marine Corps, *U.S. Marine Corps Concept & Programs 2010*, 2010, p 138.

<sup>22</sup> U.S. Department of the Navy, *Broad Agency Announcement (BAA) Next Generation Jammer Technology Maturation*, Naval Air Systems Command, Patuxent River, MD: Department of the Navy, 2009, p 3.

<sup>23</sup> Marine Corps Department of Aviation, Weapons Requirements Branch (APW-41), "MAGTF Electronic Warfare briefing" (presentation to the Director Air Warfare, November 2010), slide 6.

<sup>24</sup> Deputy Commandant for Aviation, *Fiscal Year 2011 Marine Aviation Plan*, 2010, p 6-2.

<sup>25</sup> U.S. Army Unmanned Aircraft Systems Center of Excellence, *Eyes of the Army, U.S. Army Roadmap for Unmanned Aircraft Systems 2010-2035* (Fort Rucker, AL: U.S. Army Unmanned Aircraft Systems Center of Excellence, 2010), p 12-13, <http://www.rucker.army.mil/usaace/uas/US%20Army%20UAS%20RoadMap%202010%202035.pdf> (accessed November 4, 2010).

<sup>26</sup> Deputy Commandant for Aviation, *Fiscal Year 2011 Marine Aviation Plan*, 2010, p 6-2.

<sup>27</sup> Office of Naval Research, *USMC Software Reprogrammable Payload Fact Sheet*, (Arlington, VA: Department of the Navy, November 2010), <http://www.onr.navy.mil/Media-Center/Fact-Sheets/Software-Reprogrammable-Payload.aspx> (accessed November 29, 2010).

<sup>28</sup> Headquarters United States Marine Corps, *Electronic Warfare*, September 10, 2002, p 5-1.

<sup>29</sup> Headquarters United States Marine Corps, *Electronic Warfare*, September 10, 2002, p 5-1.



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<sup>30</sup> Robert K. Ackerman, "Iraq Hones Army Electronic Warfare", *SIGNAL Magazine*, June 2007, p 23.

<sup>31</sup> Deputy Commandant for Aviation, *Fiscal Year 2011 Marine Aviation Plan*, 2010, p 6-2, 11-5.

<sup>32</sup> Lieutenant General George J. Trautman III, USMC, "Air, Space, and Cyberspace Power in the 21<sup>st</sup> Century, 38<sup>th</sup> IFPA-Fletcher Conference on National Security Strategy and Policy" (presentation, The Ronald Reagan Building and International Trade Center, Washington, D.C., January 21, 2010).

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